



Alliance

SOURCE TESTING



Site Specific Test Plan

Longs Peak Resources, LLC
1416 B Campbell Road Suite 208
Houston TX 77055

Motu 28-21-16-1CH Well Site
Enclosed Combustor – OOOOa Test

Proposed Test Date: January 15, 2019

AST Project No. 2019-0128

Regulatory Information

Permit No.(s)
Regulatory Citation(s) 40 CFR Part 60, Subpart OOOOa

Source Information

Source Name
Enclosed Combustor

Target Parameter(s)
TOC / VOC & VE

Contact Information

Test Location	Test Company	Regulatory
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1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Longs Peak Resources, LLC (LPR) to conduct emissions testing services at Motu 28-21-16-1CH well site located in Weld County, Colorado.

Testing will include determining the concentrations and mass rates of total volatile organic (TOC) and volatile organic compounds (VOC) from the inlet and outlet of an enclosed combustor to determine the destruction rate efficiency (DRE) of the enclosed combustor. Additionally, the opacity of visible emission (VE) will be determined from the enclosed combustor. Performance testing will be conducted in accordance with methods and procedures outlined in 40 CFR Part 60, Subpart OOOOa (§60.5413a). Test results will be compared with performance standards outlined in 40 CFR Part 60, Subpart OOOOa (§60.5412a(d)(1)(iv)).

This site-specific test plan (SSTP) has been prepared to address the notification and testing requirements of the federal subpart.

1.1 Process/Control System Descriptions

Motu 28-21-16-1CH well site is located in Weld County, Colorado. One (1) enclosed combustor is in service for the control of VOC and hazardous air pollutants (HAPS) associated with one (1) separator and four (4) 400 barrel fixed roof storage vessels used to store crude oil.

The enclosed combustor is a 96" diameter combustor 35' Crimson energy CE 1000 with a capacity of 1 million cubic feet per day (MMcfd). The enclosed combustor is equipped with a pilot light, combustion chamber thermocouple and fuel meter. The combustor is not equipped to run on supplemental fuel.

1.2 Project Team

Personnel planned to be involved in this project are identified in Table 1-1.

Table 1-1
Project Team

Company	Personnel
LPR	Angie Galvan
EPA Region 8	Laurie Ostrand
AST	Curtis Schohn other field personnel assigned at time of testing event

2.0 Summary of Test Program

Testing will be performed in accordance with specifications stipulated in U.S. Environmental Protection Agency (EPA) reference test methods (RM) 1, 2, 2A, 3A, 4, 18, 22 and 25A referenced in 40 CFR Part 60, Appendix A.

The test program will determine the VOC DRE of the enclosed combustor. Methane and ethane content will be excluded from the DRE calculations. The VOC DRE will be determined on a mass basis as propane.

At the inlet and outlet sampling locations, three, 1-hour test runs will be conducted to determine the concentrations of TOC in accordance with RM 25A. Integrated bag samples will be collected per test run at each sample location to determine methane and ethane content in accordance with RM 18. The methane and ethane measurements will be subtracted from the TOC measurements on a mass basis.

At the inlet, volumetric flow rate (VFR) will be measured in accordance with RM 2A using an inline flow meter. The inlet RM 25A sampling system will utilize a dilution unit to ensure TOC measurements are within the analyzer span range of 10,000 ppm. The dilution ratio will be on the scale of 400 to 1. At the outlet, VFR, gas velocity, oxygen (O₂), carbon dioxide (CO₂) and moisture (H₂O) content will be measured in accordance with RM 1, 2, 3A and 4.

One, 20-minute VE observation period will be conducted in accordance with RM 22. VE observations may not be simultaneous with other testing.

2.1 Process/Control System Parameters to be Monitored and Recorded

Testing will be conducted with the involved processes operating at the average production rate achieved in the previous three years. LPR personnel will collect operational data during testing to be incorporated in the test report, including;

- fuel consumption (standard volume per time)
- combustion zone temperature.

2.2 Proposed Test Schedule

The testing is scheduled for the week of January 14, 2019. The testing will require one (1), approximate, 10-hour test day to complete. Testing personnel will arrive on-site the day of testing to set up the necessary sampling apparatus. Table 2-1 presents an outline and tentative schedule for the emissions testing program.

Table 2-1
Program Outline and Tentative Test Schedule

Testing Location	Parameter	EPA Method	Runs	Run Duration	Est. Onsite Time
Day 1 – January 14, 2019					
Safety, Equipment Setup & Pretest QA/QC Checks					6-hours
Day 2 – January 15, 2019					
Enclosed Combustor Inlet	VFR	1, 2A	3	60-minutes	10-hours
	Methane, Ethane	18			
	TOC	25A			
Enclosed Combustor Outlet	VFR	1, 2	3	60-minutes	
	O ₂ , CO ₂	3A			
	H ₂ O	4			
	Methane, Ethane	18			
	TOC	25A			
	VE	22	1	20-minutes	

2.3 Emission Limits

The source identification and applicable emission standards are provided in Table 2.2.

Table 2-2
Emission Limits

Source	Emission Limit	Citation
Enclosed Combustor	VOC: 95% DRE TOC: 275 ppmvw @ 3% O ₂ VE: < 1-minute per 15-minute period	40 CFR Part 60, Subpart OOOOa (\$60.5412a).

2.4 Test Report

The final test report must be submitted EPA within 60-days of the test completion and will include the following information.

- *Introduction* – Brief discussion of project scope of work and activities.
- *Results and Discussion* – A summary of test results and process/control system operational data with comparison to regulatory requirements or vendor guarantees along with a description of process conditions and/or testing deviations that may have affected the testing results.
- *Methodology* – A description of the sampling and analytical methodologies.
- *Sample Calculations* – Example calculations for each target parameter.
- *Field Data* – Copies of actual handwritten or electronic field data sheets.

- *Laboratory Data* – Copy of laboratory report(s) and chain(s) of custody.
- *Quality Control Data* – Copies of all instrument calibration data and/or calibration gas certificates.
- *Process Operating/Control System Data* – Process operating and control system data (as provided by Longs Peak) to support the test results when necessary.

3.0 Testing Methodology

This section provides a description of the sampling and analytical procedures that will be employed during the test program. All equipment, procedures and quality assurance measures necessary for the completion of the test program meet or exceed the specifications of the EPA RM 1, 2, 2A, 3A, 4, 18, 22 and 25A referenced in 40 CFR Part 60, Appendix A. The emission testing program will be conducted in accordance with the test method listed in Table 3-1.

Table 3-1
Source Testing Methodology

Parameter	EPA Reference Test Method	Notes/Remarks
Enclosed Combustor Inlet		
VFR	1, 2A	Inline Meter
Methane, Ethane	18	Bag Samples, GC Analysis
TOC	25A	Instrumental Analysis
Enclosed Combustor Outlet		
VFR	1, 2	Full Velocity Traverses
O ₂ , CO ₂	3A	Instrumental Analysis
H ₂ O	4	Gravimetric Analysis
Methane, Ethane	18	Bag Samples, GC Analysis
TOC	25A	Instrumental Analysis
VE	22	Certified Observer

The outlet sampling location will be a vertical, circular stack with two sampling ports arranged at 90 degrees in accordance with EPA RM 1. The sampling ports are located at least 2 diameters downstream of a bend and greater than ½ diameters upstream of the stack exhaust, in accordance with EPA RM 1. Stack gas velocity traverse points will be located in accordance with EPA RM 1. Prior to testing, a 3-point stratification traverse will be completed to determine O₂, CO₂ and TOC sampling points. An inline flow meter will be in place to measure inlet VFR in accordance with RM 2A. RM 18 and 25A inlet measurements will be conducted from a single point. Table 3-2 provides source identification, stack dimensions and the number of sampling points.

Table 3-2
Sample Location Summary

Source Identification	Diameter (inches)	Port Location to Nearest Disturbance	Traverse Points
Enclosed Combustor Inlet	8"	Upstream: > 1/2D Downstream: > 2 D	N/A
Enclosed Combustor Outlet	96"	Upstream: > 1/2D Downstream: > 2 D	16

3.1 Enclosed Combustor - Inlet

3.1.1 U.S. EPA Reference Test Method 2A – Volumetric Flow Rate

VFR at the inlet will be measured in accordance with EPA RM 2A

A gas volume meter is in place upstream of the combustor inlet to directly measure the volume of gas. Temperature, pressure and volume readings will be recorded in 5 to 10-minute increments. The total gas volume per test run will be corrected to standard conditions and reported in units of actual cubic feet per minute (acfm) and dry standard (1 atmosphere and 68°F) cubic feet per minute (dscfm).

3.1.2 U.S. EPA Reference Test Method 18 – Methane and Ethane

Methane and ethane levels will be determined in accordance with EPA RM 18 using integrated bag sampling and analysis procedures detailed in the method.

The bag samples will be analyzed in triplicate for methane and ethane at the AST Lab in Arvada, Colorado. Samples will be analyzed using an HP Model 5890 Series II Gas Chromatograph equipped with a flame ionization detector (FID) and Chemstation software.

Gas phase calibration standards will be used to generate a three-point calibration curve for each analyte. Triplicate (minimum, more if required to meet the 5% agreement limit) injections will be conducted, and a calibration curve of peak area versus concentration will be prepared. A least squares line ($y=mx$) will be fit to each data set.

Following analysis of the samples, the mid-level calibration standard will be re-analyzed at the gas sampling valve in triplicate. If the average of the initial calibration response (triplicate average) and the post-test check response (triplicate average) are within 5% of their mean value, the initial calibration linear regression data will be used to quantify the emission levels. Otherwise, the low-level and high-level calibration standards will be re-analyzed in triplicate to generate a new six-point linear regression (using the initial and post-test data) for quantifying emission levels.

The results of the GC analyses will be used to calculate VOC levels in units of percent, dry volume basis (%vd as propane). Methane and ethane concentrations will be subtracted on a mass basis from the concentration data.

3.1.3 U.S. EPA Reference Test Method 25A – Total Organic Compounds

TOC concentrations will be measured in accordance with RM 25A using a hydrocarbon analyzer.

Each sampling period will consist of extracting a hot, wet gas sample from the stack at a constant flow rate of approximately two liters per minute using a heated ($\geq 220^\circ\text{F}$) Teflon line. The gas will be directed through a Millennium Instruments Inc. Gas Dilution Unit and into a column of the Thermo Model 51i (or equivalent) flame ionization analyzer. TOC concentrations will be displayed on the analyzer front panel in units of parts per million, wet volume basis (ppmvw – as propane) and logged to a CDAS.

The dilution system involves flowing dilution air into an eductor assembly, which then creates a vacuum to draw stack gas through an orifice. The diluted sample exits the eductor assembly to be directed to appropriate analyzer(s).

The entire assembly is fairly compact and is enclosed in a heated box at the end of the sampling probe. Prior to testing, triplicate Protocol 1 propane standards will be used to calibrate the analyzer. A dilution factor will be determined by passing three high level calibration gases through the system and the average dilution factor will be used to determine inlet TOC levels.

Prior to sampling, the analyzer will be challenged with the zero and high-level EPA Protocol 1 calibration gases to linearize the instrument. Then the low and mid-level calibration gases will be introduced through the sampling system. The sampling system is acceptable, if the linear relationship between the zero and high-level calibration gases predict the low and mid-level calibration gas measurement system response within 5% of the respective calibration gas value. The system response time will be determined with the triplicate average time required to reach a 95% step change when introducing the zero gas and then the high-level calibration gas through the sampling system.

After each sampling period, the measurement system will be challenged with the zero and mid-level calibration gas. If the analyzer drift exceeds 3% of the analyzer span (80-90% of high-level calibration gas), then the system will be re-linearized with the zero and high-level calibration gases, and the measurement system verified with the low and mid-level calibration gases. If the drift limits are exceeded, the results will be reported using both sets of calibration data.

A Data Acquisition System with battery backup will be used to record the instrument response in one-minute averages. The data will be continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data will also be saved to the AST server. All data will be reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data will be relinquished to the report coordinator and then a final review will be performed by the Project Manager.

Following sampling, the CDAS data will be averaged in one-minute increments and reported as average emission concentrations for each sampling period. The TOC concentration data will be combined with concurrently collected flow data to calculate TOC mass rates in units of lb/hr as propane.

3.2 Enclosed Combustor - Outlet

3.2.1 U.S. EPA Reference Test Methods 1 & 2 – Volumetric Flow Rate

The sampling location and number of traverse points will be selected in accordance with EPA RM 1. To determine the minimum number of traverse points, the upstream and downstream distances will be equated into equivalent diameters and compared to Figure 1-2 in EPA RM 1. All stack diameters, depths, widths, upstream and downstream disturbance distances and nipple lengths will be measured on site with a verification measurement provided by the Field Team Leader.

Full velocity traverses will be conducted in accordance with EPA RM 2 to determine the stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system will consist of a pitot tube and inclined manometer. The stack gas temperature will be measured with a K-type thermocouple and pyrometer. The pitot assembly will be leak checked pre and post each sampling period.

The temperature and differential pressure traverse data will be combined with concurrently collected diluent data to calculate the stack gas velocity and volumetric flow rate in units of feet per second (ft/sec), actual cubic feet per minute (acfm), dry standard (1 atmosphere and 68°F) cubic feet per minute (dscfm) and pounds per hour (lb/hr).

3.2.2 U.S. EPA Reference Test Method 3A – O₂ and CO₂

O₂ and CO₂ emission concentrations will be measured in accordance with EPA RM 3A (O₂ and CO₂).

Each sampling period consisted of extracting a gas sample from 12-points located across the diameter of the stack at a constant flow rate of approximately two liters per minute (lpm). Data will be collected online and reported in one-minute averages. The sampling system will consist of a stainless steel probe, Teflon sample line(s), gas conditioning system and appropriate gas analyzer. The gas conditioning system will be a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line is used, then a portable non-contact condenser will be placed in the system directly after the probe. Otherwise, a heated Teflon sample line will be used.

The initial three-point calibration test for each species will be conducted in direct calibration mode. Before and after each sampling period, the sample system will be challenged with calibration gases for a system bias check, and to quantify zero and span drift for the previous sampling period. The time required for the analyzer reading to reach 95% of the high-level gas concentration will be recorded to determine the response time of the sampling system. The calibration gases will be prepared and certified in accordance with EPA Protocol 1.

The initial 3-point calibration error must be less than $\pm 2\%$ of the calibration span gas (CS). The sampling system bias recorded during the performance test must be less than $\pm 5\%$ of the CS. The zero and span calibration drift must not exceed $\pm 3\%$ of the CS over the period of each run. If the bias values exceed the specified limits, the run is void. If the drift values exceed the specified limits, the results will be reported using pre and post run calibration data. In both cases, another 3-point calibration and 2-point bias verification must be passed before the next run.

A Data Acquisition System with battery backup will be used to record the instrument response in one-minute averages. The data will be continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data will also be saved to the AST server. All data will be reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data will be relinquished to the report coordinator and then a final review will be performed by the Project Manager.

Emission concentrations will be averaged and corrected for instrumental drift, and reported as average O₂ and CO₂, emission concentrations for each test run in units of %vd.

3.2.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content will be determined in accordance with EPA RM 4.

For each test run, a sample of gas for moisture determination will be extracted from the stack at a constant flow rate of no more than 0.75 cubic feet per minute (cfm). The gas sample will pass through a stainless-steel probe, through a series of four (4) chilled glass impingers, and through a calibrated dry gas meter. In lieu of EPA RM 4 Section 8.1.1.1 requirements, a single sample point will be used for moisture determination.

Prior to sampling, the first two impingers each will be seeded with 100 milliliters of water. The third impinger will be empty. The fourth impinger will be seeded with 250 grams of dried silica gel. The sampling system will be leak checked pre and post each sampling period. Following sampling, the moisture gain in the impingers will be measured gravimetrically and compared to the total sample volume (standard conditions) to determine the moisture content of the gas.

3.2.4 U.S. EPA Reference Test Method 18 – Methane and Ethane Content

Methane and ethane emission levels will be determined in accordance with EPA RM 18 using integrated bag sampling and analysis procedures detailed in the RM.

Once per sampling period an integrated sample will be collected in a clean, leak free Tedlar bag using the direct pump sampling procedures outlined in EPA RM 18. Each bag sample will be analyzed in triplicate for methane and ethane at the AST Lab in Arvada, Colorado. Samples will be analyzed using an HP Model 5890 Series II Gas Chromatograph equipped with a flame ionization detector (FID) and Chemstation software.

Gas phase calibration standards will be used to generate a three-point calibration curve for each analyte. Triplicate (minimum, more if required to meet the 5% agreement limit) injections will be conducted, and a calibration curve of peak area versus concentration will be prepared. A least squares line ($y=mx$) will be fit to each data set.

Following analysis of the samples, the mid-level calibration standard will be re-analyzed at the gas sampling valve in triplicate. If the average of the initial calibration response (triplicate average) and the post-test check response (triplicate average) are within 5% of their mean value, the initial calibration linear regression data will be used to quantify the emission levels. Otherwise, the low-level and high-level calibration standards will be re-analyzed in triplicate to generate a new six-point linear regression (using the initial and post-test data) for quantifying emission levels.

The results of the GC analyses will be used to calculate VOC emission levels in units of parts per million, dry volume basis (ppmvd as propane). Methane and ethane concentrations will be subtracted from the TOC concentration data on a mass basis.

3.2.5 U.S. EPA Reference Test Method 22 – Opacity of Visible Emissions

Visible emissions will be determined in accordance to EPA RM 22.

An observer will continuously visually monitor the flare for smoke for 20-minute periods followed by 5-minute breaks (as required by 40 CFR Part 60, Appendix A, Method 22, Section 11.4, 7-01-05 Edition). During observation periods, a stopwatch will be started upon observation of visible emissions. The stopwatch will continue to run until the end of the visible emission. The accumulated elapsed time on the stopwatch is the total visible emission time for the observation period, and will be recorded.

3.2.6 U.S. EPA Reference Test Method 25A – Total Organic Compounds

TOC concentrations will be measured in accordance with EPA RM 25A.

Each sampling period will consist of extracting a hot, wet gas sample from the stack at a constant flow rate at a constant flow rate of approximately two liters per minute using a heated ($\geq 220^{\circ}\text{F}$) Teflon line. The gas will be directed into a column of the Thermo Model 51i (or equivalent) flame ionization analyzer. TOC concentrations will be displayed on the analyzer front panel in units of parts per million, wet volume basis (ppmvw – as propane) and logged to a CDAS.

Prior to sampling, the analyzer will be challenged with the zero and high-level EPA Protocol 1 calibration gases to linearize the instrument. Then the low and mid-level calibration gases will be introduced through the sampling system. The sampling system is acceptable, if the linear relationship between the zero and high-level calibration gases predict the low and mid-level calibration gas measurement system response within 5% of the respective calibration gas value. The system response time will be determined with the triplicate average time required to reach a 95% step change when introducing the zero gas and then the high-level calibration gas through the sampling system.

After each sampling period, the measurement system will be challenged with the zero and mid-level calibration gas. If the analyzer drift exceeds 3% of the analyzer span (80-90% of high-level calibration gas), then the system will be re-linearized with the zero and high-level calibration gases, and the measurement system verified with the low and mid-level calibration gases. If the drift limits are exceeded, the results will be reported using both sets of calibration data.

A Data Acquisition System with battery backup will be used to record the instrument response in one-minute averages. The data will be continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data will also be saved to the AST server. All data will be reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data will be relinquished to the report coordinator and then a final review will be performed by the Project Manager.

Following sampling, the CDAS data will be averaged in one-minute increments and reported as average emission concentrations for each sampling period. The TOC concentration data will be combined with concurrently collected flow data to calculate TOC emissions in units of lb/hr as propane.

4.0 Quality Assurance Program

AST follows the procedures outlined in the Quality Assurance/Quality Control (QA/QC) Management Plan to ensure the continuous production of useful and valid data throughout the course of this test program. The QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme. Adherence to prescribed procedures is quite often the most applicable QC check.

4.1 Equipment

Field test equipment is assigned a unique, permanent identification number. Prior to mobilizing for the test program, equipment is inspected before being packed to detect equipment problems prior to arriving on site. This minimizes lost time on the job site due to equipment failure. Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. Therefore, replacements for critical equipment or components are brought to the job site. Equipment returning from the field is inspected before it is returned to storage. During these inspections, items are cleaned, repaired, reconditioned and recalibrated where necessary.

4.2 Field Sampling

Field sampling will be done in accordance with the Standard Operating Procedures (SOP) for the applicable test method. At the completion of testing, the data will also be saved to the AST server. All data will be reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data will be relinquished to the report coordinator and then a final review will be performed by the Project Manager. General QC measures for the test program include:

- Sample trains will be leak checked before and after each test run.
- The sampling port will be sealed to prevent air from leaking from the port.
- Dry gas meter, ΔP , ΔH , temperature and pump vacuum data will be recorded each sample point.
- All raw data will be maintained in organized manner.
- All raw data will be reviewed daily for completeness and acceptability.